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(54) Title: WATER-SOLUBLE CONTAINERS

(57) Abstract: A process for producing an inflated, water-soluble container which comprises: a) forming an open container from a water-soluble film; b) at least partially filling the container with a composition which comprises a component which releases a gas; c) sealing the container; and d) allowing the container to inflate.

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WATER-SOLUBLE CONTAINERS

The present invention relates to inflated, water-soluble containers and to a process for their preparation.

5

It is known to package chemical compositions which may be of a hazardous or irritant nature in water-soluble or water-dispersible materials such as films. The package can simply be added to water in order to dissolve or  
10 disperse the contents of the package into the water.

For example, WO 89/12587 discloses a package which comprises an envelope of a water-soluble or water dispersible material which comprises a flexible wall and  
15 a water-soluble or water-dispersible heat seal. The package may contain an organic liquid comprising, for example, a pesticide, fungicide, insecticide or herbicide.

20 It is also known to package detergents in water-soluble or water-dispersible containers. For example, WO 94/14941 discloses a water-soluble or water-dispersible capsule containing an aqueous dishwasher detergent. The capsule is made of gelatin.

25

CA-A-1,112,534 discloses a packet made of a water-soluble material in film form enclosing within it a paste-form, automatic dishwasher-compatible detergent composition. The water-soluble material may be, for  
30 example, poly(vinyl alcohol), polyethylene oxide or methyl cellulose. Example 1 illustrates an embodiment

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wherein a poly(vinyl alcohol) (PVOH) film is made into a 5cm square packet by heat sealing its edges, and the packet is filled with a composition which contains 8.5 wt.% water.

5

It is also known to form water-soluble containers by thermoforming a water-soluble material. For example, WO 92/17382 discloses a package containing an agrochemical such as a pesticide comprising a first  
10 sheet of non-planar water-soluble or water-dispersible material and a second sheet of water-soluble or water-dispersible material superposed on the first sheet and sealed to it by a continuous closed water-soluble or water-dispersible seal along a continuous region of the  
15 superposed sheets. It is stated to be advantageous to ensure that the package produced is evacuated of air or the contents are under reduced pressure to provide increased resistance to shock.

20 In order to improve the strength of packages containing liquids, it is also known to provide the package with residual inflatability. Thus, for example, EP-A-524,721 describes a water-soluble package which contains a liquid, wherein the package is inflatable to a volume  
25 which is greater than the initial volume of the package. Thus the package is filled to less than its complete capacity, and the unused capacity may be partially, but not totally, filled with a gas such as air. The unused capacity which does not contain gas provides the  
30 residual inflatability.

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In fields such as detergents for domestic use, an attractive appearance for an article is extremely desirable. However, in the prior art such as that described above, the packages do not have an attractive appearance. For example, the packages disclosed in WO 92/17382 are likely to have a non-uniform appearance because they are packaged under reduced pressure. When a bag is formed from a single sheet of water-soluble film by folding the film and heat-sealing the edges to form the bag, which is then filled, such as described in CA-A-1,112,534, the product obtained can be a rather flat, limp envelope containing the product. Again there may also be lack of uniformity between different bags because of their flexible nature.

15

We have discovered that this type of product is not deemed to be attractive by an average consumer.

The present invention seeks to provide a water-soluble container containing a composition, which container has a more attractive appearance. In particular the container should be relatively self-supporting and look full. Ideally the container should have an attractive, rounded three-dimensional appearance.

25

EP-A-654,418 describes self-standing flexible pouches which may contain, for example, liquid detergent compositions for refilling other containers. The pouches are cut open and the contents poured into the containers to be refilled. Thus they are not water-soluble. In order to avoid folding of the pouches,

30

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which can lead to cracking and leakage, the pouches are inflated by pumping in air before they are sealed.

We have now surprisingly discovered a water-soluble  
5 container which contains a composition having an attractive three-dimensional appearance by ensuring that the container is inflated after it has been sealed.

The present invention accordingly provides a process for  
10 producing an inflated, water-soluble container which comprises:

- a) forming an open container from a water-soluble film;
- b) at least partially filling the container with a  
15 composition which comprises a component which releases a gas;
- c) sealing the container; and
- d) allowing the container to inflate.

20 The present invention also provides an inflated water-soluble container comprising a water-soluble film enclosing a liquid or solid composition and a gas, wherein the gas is enriched with at least one gaseous component as compared with air or comprises at least one  
25 gaseous component not normally present in air.

The initial step (a) of the process of the invention comprises forming an open container from a water-soluble film. A suitable water-soluble film is a poly(vinyl  
30 alcohol) (PVOH) film.

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The PVOH film may be partially or fully alcoholised or hydrolysed, for example, it may be from 40 to 100%, preferably 70 to 92%, more preferably about 88% or about 92%, alcoholised or hydrolysed, polyvinyl acetate film.

- 5 The degree of hydrolysis is known to influence the temperature at which the PVOH starts to dissolve in water. 88% hydrolysis corresponds to a film soluble in cold (i.e. room temperature) water whereas 92% hydrolysis corresponds to a film soluble in warm water.
- 10 An example of a preferred PVOH is ethoxylated PVOH. The film may be cast, blown or extruded. It may also be unorientated, mono-axially oriented or bi-axially oriented.
- 15 The film may also comprise a cellulose derivative such as hydroxy propyl methyl cellulose (HPMC). A suitable HPMC is, for example, M900 obtained from Enak Ltd.

It is possible for suitable additives such as

- 20 plasticisers, lubricants and colouring agents to be added to the film. Components which modify the properties of the polymer may also be added.
- Plasticisers are generally used in an amount of up to 35 wt%, for example from 5 to 35 wt%, preferably from 7 to
- 25 20 wt%, more preferably from 10 to 15 wt%. Lubricants are generally used in an amount of 0.5 to 5 wt%. The polymer is therefore generally used in an amount of from 60 to 94.5 wt%, based on the total amount of the composition used to form the film. Suitable
- 30 plasticisers are, for example, pentaerythritols such as depentaerythritol, sorbitol, mannitol, glycerine and

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glycols such as glycerol, ethylene glycol and polyethylene glycol. Solids such as talc, stearic acid, magnesium stearate, silicon dioxide, zinc stearate or colloidal silica may also be used.

5

It is also possible to include one or more particulate solids in the films in order to accelerate the rate of dissolution of the container. This solid may also be present in the contents of the container. Dissolution  
10 of the solid in water is sufficient to cause an acceleration in the break-up of the container, particularly if a gas is generated, when the physical agitation caused may, for example, result in the virtually immediate release of the contents from the  
15 container. Examples of such solids are alkali or alkaline earth metal, such as sodium, potassium, magnesium or calcium, bicarbonate or carbonate, in conjunction with an acid. Suitable acids are, for example, acidic substances having carboxylic or sulfonic  
20 acid groups or salts thereof. Examples are cinnamic, tartaric, mandelic, fumaric, maleic, malic, palmoic, citric and naphthalene disulfonic acids.

The film is generally cold water (20°C) soluble, but may  
25 be insoluble in cold water at 20°C and only become soluble in warm water or hot water having a temperature of, for example, 30°C, 40°C, 50°C or even 60°C. This parameter is determined in the case of PVOH by its degree of hydrolysis.

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It is particularly important to avoid pinholes in the film through which leakage of the contained composition may occur. It may therefore be appropriate to use a laminate of two or more layers of a different or the same film, as pinholes are unlikely to coincide in two layers of material.

The open container may be formed by any means. For example, it may be formed by thermoforming a PVOH film to produce a non-planar sheet containing a pocket, such as a recess, which is able to retain the composition. The pocket is generally bounded by a flange, which is preferably substantially planar. The pocket may have internal barrier layers as described in, for example, WO 93/08095. Thus the container may be formed, for example, by a process which is similar to that disclosed in WO 92/17382.

Alternatively the container may be prepared by producing an open-top bag by forming a film around a shoulder and then heat-sealing simultaneously the bottom and sides of the bag. Other methods of sealing may be used, for example infra-red, radio frequency, ultrasonic, laser, solvent, vibration, electromagnetic, hot gas, hot plate, insert bonding, friction sealing or spin welding. An adhesive such as water or an aqueous solution of PVOH may also be used. The adhesive can be applied to the film by spraying, transfer coating, roller coating, or the film can be passed through a mist of the adhesive. The seal desirably is also water-soluble. Such a process is described for example in EP-A-728,673.



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Another method for forming the open container is to seal two films together on three sides of the pocket by superimposing the films on each other and sealing them  
5 together as described in WO 95/23099.

When a single water-soluble film is used, or if two films are used which are not thermoformed, the films generally have a thickness of 20 to 500  $\mu\text{m}$ , especially  
10 30 to 160  $\mu\text{m}$ , preferably from 40 to 120  $\mu\text{m}$ , more preferably from 50 to 100  $\mu\text{m}$ .

When a first and second water-soluble film are used to form the containers of the present invention, the first  
15 film will generally have a thickness before thermoforming of 20 to 500  $\mu\text{m}$ , especially 70 to 400  $\mu\text{m}$ , for example 70 to 300  $\mu\text{m}$ , most preferably 70 to 160  $\mu\text{m}$ , especially 75 to 100  $\mu\text{m}$  or 90 to 110 to 150  $\mu\text{m}$ . The thickness of the second film may be less than that of  
20 the first film as the second film will not generally be thermoformed so localised thinning of the sheet will not occur. The thickness of the second film will generally be from 20 to 150  $\mu\text{m}$  or 160  $\mu\text{m}$ , preferably from 40 or 50 to 90 or 100  $\mu\text{m}$ , more preferably from 50 to 80  $\mu\text{m}$ .  
25 The films may be chosen, if desired, such that they have the same thickness before the first film is thermoformed, or have the same thickness after the first sheet has been thermoformed in order to provide a composition which is encapsulated by a substantially  
30 constant thickness of film.

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In step (b) the container is at least partially filled with a composition. The container may be completely filled, or only partially filled, for example to leave  
5 an air space from 2 to 20 %, especially from 5 to 10%, of the volume of the container immediately after it is formed.

The nature of the composition is not limited. It may,  
10 for example, be a solid or a liquid. If it is in the form of a solid it may, for example, be in the form of a powder, granules, an extruded tablet, a compressed tablet or a solidified gel. If it is in the form of a liquid it may be optionally thickened or gelled with a  
15 thickener or a gelling agent. One or more than one phase may be present. For example the container may be filled with a liquid composition and a separate solid composition, for example in the form of a ball, pill or speckles. Alternatively two or more solid phases, or two  
20 or more immiscible liquid phases, may be present.

Thus the composition need not be uniform. For example, during manufacture the container could first be filled with a settable composition, for example a gel and then  
25 with a different composition. Each of the compositions is independently aqueous. The first composition could dissolve slowly, for example in a washing process, so as to deliver it over a long period. This might be useful, for example, to provide an immediate, delayed or  
30 sustained delivery of a component such as a softening agent.

- 10 -

If the water-soluble container is soluble in cold water at room temperature (20°C) or slightly above, it is important to ensure that the composition itself does not dissolve the container. In general solid compositions will not attack the container, and neither will liquid organic compositions which contain less than around 5% of water as described, for example, in WO 92/17382. If the composition is in the form of a liquid containing more than about 5 wt% water, action must be taken to ensure that the composition does not attack the walls of the container. Steps may be taken to treat the inside surface of the film, for example by coating it with an agent such as PVdC (poly(vinylidene dichloride)) or PTFE (polytetrafluoroethylene). A semi-permeable or partial water barrier such as polyethylene or polypropylene or a hydrogel such as a polyacrylate may also be provided as a coating. The coating will simply fall apart or dissolve or disperse into microscopic particles when the container is dissolved in water. Steps may also be taken to adapt the composition to ensure that it does not dissolve the film. For example, it has been found that ensuring the composition has a high ionic strength or contains an agent which minimises water loss through the walls of the container will prevent the composition from dissolving a PVOH film from the inside. This is described in more detail in EP-A-518,689 and WO 97/27743.

A component which releases a gas is added to the composition. This component may be added separately or

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with the remaining components. Thus, for example, the component, or one of the components of a multi-component gas releasing system, may be added first and the remainder of the composition added afterwards. Another  
5 possibility is that the components, or one of the components of a multi-component gas releasing system, may be added after the remainder of the composition. It is also possible for all of the components to be added together in a single composition.

10

The component which releases a gas may, for example, comprise a component or a mixture of two or more components which react in the presence of the contents of the container to release a gas. For example, when  
15 water is present in the composition, two components which do not react when in solid form but which will react in the presence of water can be added, such as an acid and a carbonate or bicarbonate. An example of a suitable acid is citric acid. Examples of suitable  
20 carbonates and bicarbonates are sodium and potassium carbonate and sodium and potassium bicarbonate.

Another possibility is that a component is added which is able to react with a component already present in the  
25 composition contained in the container. For example, an acid may be present within the composition held within the container, and a carbonate or bicarbonate as described above subsequently added. Alternatively a carbonate or bicarbonate may be present in the  
30 composition, and an acid subsequently added.

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In the above cases, the component which releases a gas may be added in solid form or in a solvent such as water or an organic solvent. The rate of release of the gas may be controlled. For example, a finely divided powder  
5 will release the gas quicker than a compressed tablet. If desired, the component may be encapsulated by a substance which delays the release of the gas.

A further possibility is to add a component to the  
10 composition which is a gas at room temperature (20° C) but which, at the time which it is added, is in the form of a solid or liquid because it has been cooled to less than its melting or boiling point. For example, solid carbon dioxide (dry ice) may be added. As the component  
15 heats up to room temperature, which may occur naturally or be aided with heating, it will boil or sublime into a gas. Another possibility is to add a compound which is thermally unstable; for example sodium bicarbonate will release carbon dioxide when it is heated to about 60°C.

20

The component which releases a gas may, for example, be a component which gradually releases a gas such as a bleach, in particular an oxygen bleach or a chlorine bleach. Such bleaches gradually releases a gas such as  
25 oxygen or a chlorine containing compound when they contact water. The water may itself be contained in the composition, be contained in another compartment and diffuse through the dividing wall into the compartment holding the bleach, or may diffuse into the composition  
30 from outside the container.

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Any component or combination of components can be used which will produce a gas. The gas should be non-toxic or produced in small quantities. It is most convenient, however, to produce carbon dioxide gas since this will  
5 not cause any environmental concerns.

After the component which releases a gas has been added, for example with or to the composition, the container is sealed in step (c). If the component which releases a  
10 gas starts to release a gas immediately, as it generally will, the container should be sealed immediately to ensure that at least some of the gas produced is retained within the container. Sealing can be carried out by any means as described above.

15

Thus, for example, if the container is in the form of a pocket formed from one or two sheets of film, the container may be sealed by heat-sealing or by any of the remaining sealing methods discussed above. The films  
20 may be sealed together, for example by heat sealing, across the flange. A suitable heat sealing temperature is, for example, 120 to 195°C, for example 140 to 150°C. A suitable sealing pressure is, for example, from 250 to 800 kPa. Examples of sealing pressures are 276 to 552  
25 kPa (40 to 80 p.s.i.), especially 345 to 483 kPa (50 to 70 p.s.i.) or 400 to 800 kPa (4 to 8 bar), especially 500 to 700 kPa (5 to 7 bar) depending on the heat sealing machine used. Suitable sealing dwell times are at least 0.4 seconds, for example 0.4 to 2.5 seconds.  
30 Other methods of sealing the films together may be used, for example infra-red, radio frequency, ultrasonic,

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laser, solvent, vibration, electromagnetic, hot gas, hot plate, insert bonding, fraction sealing or spin welding. An adhesive such as water or an aqueous solution of PVOH may also be used. The adhesive can be applied to the  
5 films by spraying, transfer coating, roller coating or otherwise coating, or the films can be passed through a mist of the adhesive. The seal desirably is also water-soluble. The second film may, for example, comprise PVOH.

10

If more than one container is formed at the same time, the packaged compositions may then be separated from each other. Alternatively, they may be left conjoined and, for example, perforations provided between the  
15 individual containers so that they can be easily separated at a later stage, for example by a consumer. If the containers are separated, the flanges may be left in place. However, desirably the flanges are partially removed in order to provide an even more attractive,  
20 three-dimensional appearance. Generally the flange remaining should be as small as possible for aesthetic purposes while bearing in mind that some flange is required to ensure the two films remain adhered to each other. A flange of 1 mm to 10 mm is desirable,  
25 preferably 2 mm to 7 mm, more preferably 4 mm to 6 mm, most preferably about 5 mm.

The containers are then allowed to inflate in step (d). The containers may be allowed to inflate, for example,  
30 at rest, or they may be packaged into boxes for retail sale, and left to inflate in the boxes. The containers

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may themselves be packaged in outer containers if desired, for example, non-water-soluble containers which are removed before the water-soluble containers are used.

5

The containers of the present invention generally contain from 5 to 100 g of composition, such as an aqueous composition, especially from 15 to 40 g, depending on their intended use. For example, a  
10 dishwashing composition may weigh from 15 to 20 g, a water-softening composition may weigh from 25 to 35 g, and a laundry composition may weigh from 10 to 40 g, especially 20 to 30 g or 30 to 40 g.

15 The containers may have any shape. For example they can take the form of an envelope, sachet, sphere, cylinder, cube or cuboid, i.e. a rectangular parallelepiped whose faces are not all equal. In general, because the containers are not rigid and are inflated, the sides are  
20 not planar, but rather are convex. If the container is formed from a thermoformed film and a planar film, the seam between the two films will appear nearer one face of the container rather than the other. Apart from the deformation of the container due to the generation of  
25 gas, deformation may also occur at the stage of manufacture if desired. For example, if the pocket is filled with a gelled composition having a height greater than that of the pocket, the second film will be deformed when placed on top of the pocket.

30



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In general the maximum dimension of the filled part of the container (excluding any flanges) is 5 cm. For example, a rounded cuboid container may have a length of 1 to 5 cm, especially 3.5 to 4.5 cm, a width of 1.5 to 3.5 cm, especially 2 to 3 cm, and a height of 1 to 2.5 cm, especially 1 to 2 cm, for example 1.25 to 1.75 cm.

The composition filling the containers is not particularly limited. It can be any composition which is to be added to an aqueous system or used in an aqueous environment. Suitable compositions are fabric care, surface care and dishwashing compositions. For example, the composition may comprise a dishwashing, water-softening, laundry or detergent composition or a rinse aid. In this case it is especially suitable for use in a domestic washing machine such as a laundry washing machine or a dishwashing machine. The container may also comprise a disinfectant, antibacterial or antiseptic composition intended to be diluted with water before use, or a concentrated refill composition, for example for a trigger-type spray used in domestic situations. Such a composition can simply be added to water already held in the spray container. Examples of surface care compositions are those used to clean, treat or polish a surface. Suitable surfaces are, for example, household surfaces, such as worktops, as well as surfaces of sanitary ware, such as sinks, basins and lavatories.

Examples of anionic surfactants are straight-chained or branched alkyl sulfates and alkyl polyalkoxylated

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sulfates, also known as alkyl ether sulfates. Such surfactants may be produced by the sulfation of higher C<sub>8</sub>-C<sub>20</sub> fatty alcohols.

- 5 Examples of primary alkyl sulfate surfactants are those of formula:



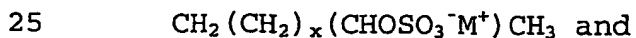
- wherein R is a linear C<sub>8</sub>-C<sub>20</sub> hydrocarbyl group and M is a water-solubilising cation. Preferably R is C<sub>10</sub>-C<sub>16</sub> alkyl, for example C<sub>12</sub>-C<sub>14</sub>, and M is alkali metal such as lithium, sodium or potassium.

- Examples of secondary alkyl sulfate surfactants are those which have the sulfate moiety on a "backbone" of the molecule, for example those of formula:



- wherein m and n are independently 2 or more, the sum of m+n typically being 6 to 20, for example 9 to 15, and M is a water-solubilising cation such as lithium, sodium or potassium.

Especially preferred secondary alkyl sulfates are the (2,3) alkyl sulfate surfactants of formulae:

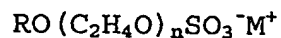


- for the 2-sulfate and 3-sulfate, respectively. In these formulae x is at least 4, for example 6 to 20,

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preferably 10 to 16. M is cation, such as an alkali metal, for example lithium, sodium or potassium.

Examples of alkoxyated alkyl sulfates are ethoxylated  
5 alkyl sulfates of the formula:



wherein R is a C<sub>8</sub>-C<sub>20</sub> alkyl group, preferably C<sub>10</sub>-C<sub>18</sub> such  
10 as a C<sub>12</sub>-C<sub>16</sub>, n is at least 1, for example from 1 to 20,  
preferably 1 to 15, especially 1 to 6, and M is a salt-  
forming cation such as lithium, sodium, potassium,  
ammonium, alkylammonium or alkanolammonium. These  
compounds can provide especially desirable fabric  
15 cleaning performance benefits when used in combination  
with alkyl sulfates.

The alkyl sulfates and alkyl ether sulfates will  
generally be used in the form of mixtures comprising  
20 varying alkyl chain lengths and, if present, varying  
degrees of alkoxylation.

Other anionic surfactants which may be employed are  
salts of fatty acids, for example C<sub>8</sub>-C<sub>18</sub> fatty acids,  
25 especially the sodium, potassium or alkanolammonium  
salts, and alkyl, for example C<sub>8</sub>-C<sub>18</sub>, benzene sulfonates.

Examples of nonionic surfactants are fatty acid  
alkoxylates, such as fatty acid ethoxylates, especially  
30 those of formula:



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wherein R is a straight or branched C<sub>8</sub>-C<sub>16</sub> alkyl group, preferably a C<sub>9</sub>-C<sub>15</sub>, for example C<sub>10</sub>-C<sub>14</sub> or C<sub>12</sub>-C<sub>14</sub>, alkyl group and n is at least 1, for example from 1 to 16, preferably 2 to 12, more preferably 3 to 10.

The alkoxyated fatty alcohol nonionic surfactant will frequently have a hydrophilic-lipophilic balance (HLB) which ranges from 3 to 17, more preferably from 6 to 15, most preferably from 10 to 15.

Examples of fatty alcohol ethoxylates are those made from alcohols of 12 to 15 carbon atoms and which contain about 7 moles of ethylene oxide. Such materials are commercially marketed under the trademarks Neodol 25-7 and Neodol 23-6.5 by Shell Chemical Company. Other useful Neodols include Neodol 1-5, an ethoxylated fatty alcohol averaging 11 carbon atoms in its alkyl chain with about 5 moles of ethylene oxide; Neodol 23-9, an ethoxylated primary C<sub>12</sub>-C<sub>13</sub> alcohol having about 9 moles of ethylene oxide; and Neodol 91-10, an ethoxylated C<sub>9</sub>-C<sub>11</sub> primary alcohol having about 10 moles of ethylene oxide.

Alcohol ethoxylates of this type have also been marketed by Shell Chemical Company under the Dobanol trademark. Dobanol 91-5 is an ethoxylated C<sub>9</sub>-C<sub>11</sub> fatty alcohol with an average of 5 moles ethylene oxide and Dobanol 25-7 is an ethoxylated C<sub>12</sub>-C<sub>15</sub> fatty alcohol with an average of 7 moles of ethylene oxide per mole of fatty alcohol.

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- Other examples of suitable ethoxylated alcohol nonionic surfactants include Tergitol 15-S-7 and Tergitol 15-S-9, both of which are linear secondary alcohol ethoxylates available from Union Carbide Corporation. Tergitol 15-S-7 is a mixed ethoxylated product of a C<sub>11</sub>-C<sub>15</sub> linear secondary alkanol with 7 moles of ethylene oxide and Tergitol 15-S-9 is the same but with 9 moles of ethylene oxide.
- 10 Other suitable alcohol ethoxylated nonionic surfactants are Neodol 45-11, which is a similar ethylene oxide condensation products of a fatty alcohol having 14-15 carbon atoms and the number of ethylene oxide groups per mole being about 11. Such products are also available
- 15 from Shell Chemical Company.

Further nonionic surfactants are, for example, C<sub>10</sub>-C<sub>18</sub> alkyl polyglycosides, such as C<sub>12</sub>-C<sub>16</sub> alkyl polyglycosides, especially the polyglucosides. These

20 are especially useful when high foaming compositions are desired. Further surfactants are polyhydroxy fatty acid amides, such as C<sub>10</sub>-C<sub>18</sub> N-(3-methoxypropyl) glycamides and ethylene oxide-propylene oxide block polymers of the Pluronic type.

25

Examples of cationic surfactants are those of the quaternary ammonium type.

Examples of amphoteric surfactants are C<sub>10</sub>-C<sub>18</sub> amine

30 oxides and the C<sub>12</sub>-C<sub>18</sub> betaines and sulfobetaines.

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The total content of surfactants in the composition is desirably 0.1 to 95 wt%, especially 60 or 75 to 90 wt%. The total content of surfactants in a laundry or detergent composition is desirably 60 to 95 wt%,  
5 especially 70 to 90 wt%. Desirably, especially in a laundry composition, an anionic surfactant is present in an amount of 50 to 75 wt%, a nonionic surfactant is present in an amount of 5 to 20 wt%, a cationic  
10 surfactant is present in an amount of from 0 to 10 wt% and/or an amphoteric surfactant is present in an amount from 0 to 10 wt%. Desirably, in a dishwashing composition, the anionic surfactant is present in an amount of from 0.1 to 50 wt%, a non-ionic surfactant is present in an amount of 0.5 to 20 wt% and/or a cationic  
15 surfactant is present in an amount of from 1 to 15 wt%. These amounts are based on the total solids content of the composition, i.e. excluding any water or solvent which may be present.

20 The compositions, particularly when used as laundry washing or dishwashing compositions, may also comprise enzymes, such as protease, lipase, amylase, cellulase and peroxidase enzymes. Such enzymes are commercially available and sold, for example, under the registered  
25 trade marks Esperase, Alcalase, Savinase, Termanyl, Lipolase and Celluzyme by Novo Industries A/S and Maxatasc by International Biosynthetics, Inc. Desirably the enzymes are present in the composition in an amount of from 0.5 to 3 wt%, especially 1 to 2 wt%.

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The compositions may, if desired, comprise a thickening agent or gelling agent. Suitable thickeners are polyacrylate polymers such as those sold under the trade mark CARBOPOL, or the trade mark ACUSOL by Rohm and Haas Company. Other suitable thickeners are xanthan gums. The thickener, if present, is generally present in an amount of from 0.2 to 4 wt%, especially 0.5 to 2 wt%.

Dishwasher compositions usually comprise a detergency builder. Suitable builders are alkali metal or ammonium phosphates, polyphosphates, phosphonates, polyphosphonates, carbonates, bicarbonates, borates, polyhydroxysulfonates, polyacetates, carboxylates and polycarboxylates such as citrates. The builder is desirably present in an amount of up to 90 wt%, preferably 15 to 90 wt%, more preferably 15 to 75 wt%, relative to the total content of the composition. Further details of suitable components are given in, for example, EP-A-694,059, EP-A-518,720 and WO 99/06522.

20

The compositions can also optionally comprise one or more additional ingredients. These include conventional detergent composition components such as further surfactants, bleaches, bleach enhancing agents, builders, suds boosters or suds suppressors, anti-tarnish and anti-corrosion agents, organic solvents, co-solvents, phase stabilisers, emulsifying agents, preservatives, soil suspending agents, soil release agents, germicides, phosphates such as sodium tripolyphosphate or potassium tripolyphosphate, pH adjusting agents or buffers, non-builder alkalinity

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sources, chelating agents, clays such as smectite clays, enzyme stabilizers, anti-limescale agents, colourants, dyes, hydrotropes, dye transfer inhibiting agents, brighteners and perfumes. If used, such optional  
5 ingredients will generally constitute no more than 10 wt%, for example from 1 to 6 wt%, of the total weight of the compositions.

The builders counteract the effects of calcium, or other ion, water hardness encountered during laundering or  
10 bleaching use of the compositions herein. Examples of such materials are citrate, succinate, malonate, carboxymethyl succinate, carboxylate, polycarboxylate and polyacetyl carboxylate salts, for example with alkali metal or alkaline earth metal cations, or the  
15 corresponding free acids. Specific examples are sodium, potassium and lithium salts of oxydisuccinic acid, mellitic acid, benzene polycarboxylic acids, C<sub>10</sub>-C<sub>22</sub> fatty acids and citric acid. Other examples are organic phosphonate type sequestering agents such as those sold  
20 by Monsanto under the trade mark Dequest and alkylhydroxy phosphonates. Citrate salts and C<sub>12</sub>-C<sub>18</sub> fatty acid soaps are preferred.

Other suitable builders are polymers and copolymers  
25 known to have builder properties. For example, such materials include appropriate polyacrylic acid, polymaleic acid, and polyacrylic/polymaleic and copolymers and their salts, such as those sold by BASF under the trade mark Sokalan.



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The builders generally constitute from 0 to 3 wt%, more preferably from 0.1 to 1 wt%, by weight of the compositions.

- 5 Compositions which comprise an enzyme may optionally contain materials which maintain the stability of the enzyme. Such enzyme stabilizers include, for example, polyols such as propylene glycol, boric acid and borax. Combinations of these enzyme stabilizers may also be  
10 employed. If utilized, the enzyme stabilizers generally constitute from 0.1 to 1 wt% of the compositions. Examples of bleaches are, for example, listed in WO 99/06522. These include oxygen releasing bleaching agents such as a hydrogen peroxide source and an organic  
15 peroxyacid bleach precursor compound or a preformed organic peroxyacid. Examples of hydrogen peroxide sources are inorganic perhydrate bleaches such as the alkali metal salts of perborate, percarbonate, perphosphate, persulfate and persilicates. Examples of  
20 organic peroxyacid bleach precursors are listed in WO 99/06522. The bleaches also include chlorine releasing agents such as hydantoins, for example 1,3-dichloro-5,5-dimethyl hydantoin, hypochlorites such as sodium hypochlorite or dichloroisocyanurates such as sodium  
25 dichloroisocyanurate.

The compositions may optionally comprise materials which serve as phase stabilizers and/or co-solvents. Example are C<sub>1</sub>-C<sub>3</sub> alcohols or diols such as methanol, ethanol,  
30 propanol, and 1, 2-propanediol. C<sub>1</sub>-C<sub>3</sub> alkanolamines such as mono-, di- and triethanolamines and

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monoisopropanolamine can also be used, by themselves or in combination with the alcohols. The phase stabilizers and/or co-solvents can, for example, constitute 0 to 1 wt%, preferably 0.1 to 0.5 wt% of the composition.

5

If the composition is in liquid form, it may be anhydrous, or, for example, contain up to 5 wt% water. Aqueous compositions generally contain greater than 8 wt% water based on the weight of the aqueous composition. Desirably the aqueous compositions contain more than 10 wt%, 15 wt%, 20 wt%, 25 wt% or 30 wt% water, but desirably less than 80 wt% water, more desirably less than 70 wt%, 60 wt%, 50 wt% or 40 wt% water. They may, for example, contain from 30 to 55 or 65 wt% water.

The compositions may optionally comprise components which adjust or maintain the pH of the compositions at optimum levels. Examples of pH adjusting agents are NaOH and citric acid. The pH may be from, for example, 1 to 13, such as 8 to 11 depending on the nature of the composition. For example, a dishwashing composition desirably has a pH of 8 to 11, a laundry composition desirably has a pH of 7 to 9, and a water-softening composition desirably has a pH of 7 to 9.

The present invention will now be further explained in the following Examples.

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Example 1

A dishwashing composition was prepared by mixing together the following components in the weight proportions indicated:

	Potassium tripolyphosphate powder	12%
	Sodium tripolyphosphate powder	30%
	Isothiazolinone	0.1%
10	Polyacrylate thickener (Carbopol)	1%
	Nonionic surfactant	0.5%
	Sodium citrate	10%
	Citric acid	0.2%
	Sodium bicarbonate	0.2%
15	Dehardened water	46%

A Multivac thermoforming machine operating at 6 cycles/min and at ambient conditions of 25°C and 35% RH ( $\pm 5\%$  RH) was used to thermoform a PVOH film. This was Monosol M8534 obtained from Chris Craft Inc, Gary, Indiana, USA, having a degree of hydrolysis of 88% and a thickness of 100  $\mu\text{m}$ . The PVOH film was thermoformed into a rectangular mould of 39 mm length, 29 mm width and 16 mm depth, with the bottom edges being rounded to a radius of 10 mm, at 115-118°C. The thus formed pocket was filled with 10 ml of the dishwashing composition, and a 75  $\mu\text{m}$  thick Monosol M8534 PVOH film was placed on top and heat sealed at 144-148°C. The thus produced containers were separated from each other by cutting the flanges. Each container attained a rounded appearance due to the generation of carbon dioxide gas.

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Example 2

The following formulations were prepared by mixing  
5 together the indicated components in the weight  
proportions indicated. In all instances the  
compositions were filled into containers following the  
procedure described in Example 1, and containers having  
an attractive, rounded appearance were obtained after  
10 the carbon dioxide gas had generated.

A laundry detergent composition:

	Sodium carbonate	20%
15	Nonylphenol ethoxylate	10%
	Accusol 820 obtainable from	
	Rohm and Hass Company	3.3%
	Sodium citrate	5%
	Citric acid	0.2%
20	Sodium bicarbonate	0.2%
	Dehardened water	61.3%

An automatic dishwasher detergent:

25	Sodium citrate	8%
	Van Gel ES thickener obtainable	
	from R.T.Vanderbilt Company	4%
	Tetrapotassium pyrophosphate	10%
30	Sodium tripolyphosphate	30%
	Anhydrous sodium metasilicate	2%

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	Sodium xylene sulfonate	2.25%
	Deceth-4-phosphate	0.75%
	Citric acid	0.2%
	Sodium bicarbonate	0.2%
5	Dehardened water	42.6%

A slurry type heavy duty laundry liquid:

	Neodol 25-7 C <sub>12-15</sub> linear alcohol	18%
10	Biosoft D-62 sodium alkylbenzenesulfonate	5.5%
	Sodium carbonate	2%
	Anhydrous sodium metasilicate	5%
	Tetrasodium pyrophosphate	20%
15	Sodium citrate	7.5%
	Carbopol ETDZ691 polymer obtainable from Goodrich	0.5%
	Citric acid	0.2%
	Sodium bicarbonate	0.2%
20	Dehardened water	41.1%

A slurry-type laundry detergent:

	Sodium carbonate	40%
25	Sodium citrate	4.8%
	Accusol 820 obtainable from Rohm and Hass	2%
	Accusol 810 obtainable from Rohm and Hass	5%
30	Sodium tripolyphosphate	10%
	Accusol 445 obtainable from	

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	Rohm and Hass	2%
	Nonylphenol ethoxylate	10%
	Citric acid	0.25%
	Sodium bicarbonate	0.25%
5	Dehardened water	26.7%

A dishwashing composition:

	Accusol 810	11%
10	Accusol 445N	4%
	Sodium tripolyphosphate	20%
	Tetrapotassium pyrophosphate	10%
	Potassium silicate	29%
	Triton CF-32 alkylamine ethoxylate	3%
15	Potassium citrate	5%
	Citric acid	0.25%
	Sodium bicarbonate	0.25%
	Dehardened water	17.4%

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CLAIMS

1. A process for producing an inflated, water-soluble container which comprises:
  - 5 a) forming an open container from a water-soluble film;
  - b) at least partially filling the container with a composition which comprises a component which releases a gas;
  - 10 c) sealing the container; and
  - d) allowing the container to inflate.
2. A process according to claim 1 wherein the container is at least partially filled with a composition and a  
15 component which releases a gas is subsequently added.
3. A process according to claim 1 wherein the container is filled with a composition which comprises a component which releases a gas in a single step.  
20
4. A process according to any one of the preceding claims wherein step (a) comprises thermoforming the film to produce a pocket.
- 25 5. A process according to claim 4 wherein step (c) comprises placing a second water-soluble film on top of the filled pocket and sealing the films together.
6. A process according to any one of the preceding  
30 claims wherein the water-soluble film is a poly(vinyl alcohol) film.

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7. A process according to any one of the preceding claim where the composition in step (b) is an aqueous or non-aqueous liquid.

5

8. A process according to claim 7 wherein the aqueous liquid contains greater than 8wt% water based on the total weight of aqueous liquid and component which releases a gas.

10

9. A process according to claim 7 or 8 wherein the component which releases a gas comprises a mixture of compounds which react in the presence of water to produce the gas.

15

10.A process according to claim 7 or 8 wherein the component which releases a gas comprises a compound which reacts with a compound in the aqueous liquid to produce the gas.

20

11.A process according to claim 10 wherein the component which releases a gas is a bleach.

12.A process according to claim 7 or 8 where the component which releases a gas is a component which is a gas at room temperature (20°C) but which is added in step (b) in the form of a cooled solid or liquid.

30 13.A process according to any one of the preceding claims wherein the gas which inflates the container



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is carbon dioxide.

14.A process according to any one of the preceding  
claims wherein the container comprises a fabric care,  
5 surface care or dishwashing composition.

15.A process according to any one of the preceding  
claims wherein the container comprises a  
dishwashing, water-softening, laundry or detergent  
10 composition or a rinse aid.

16.A process according to claim 15 wherein the  
container is suitable for use in a domestic washing  
machine.  
15

17.A process according to any one of claims 1 to 14  
wherein the container comprises a disinfectant,  
antibacterial or antiseptic composition.

20 18.A process according to any one of claims 1 to 14  
wherein the container comprises a refill  
composition for a trigger-type spray.

19.An inflated water-soluble container comprising a  
25 water-soluble film enclosing a liquid or solid  
composition and a gas, wherein the gas is enriched  
with at least one gaseous component as compared  
with air or comprises at least one gaseous  
component not normally present in air.

30

20.A container according to claim 19 wherein the

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gaseous component is carbon dioxide.

21.A container according to claim 19 wherein the gaseous  
component is oxygen or a chlorine containing  
5 component.

22.A container according to any one of claims 19 to 21  
wherein the water-soluble film is a poly(vinyl  
alcohol) film.  
10

23.A container according to any one of claims 19 to 22  
wherein the water-soluble film has been  
thermoformed to form a pocket and the pocket has  
been sealed by placing a second water-soluble film  
15 over the pocket and sealing the films together.

24.A container according to any one of claims 19 to 23  
wherein the water-soluble film has been thermoformed.

20 25.A container according to any one of claims 19 to 24  
wherein the composition is a fabric care, surface  
care or dishwashing composition.

26.A container according to any one of claims 19 to 25  
25 wherein the composition is a dishwashing, water-  
softening, laundry or detergent composition or is a  
rinse aid.

27.A container according to claim 26 which is suitable  
30 for use in a domestic washing machine.

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28.A container according to any one of claims 19 to 25  
wherein the composition is a disinfectant,  
antibacterial or antiseptic composition.

29.A container according to any one of claims 19 to 25  
5 wherein the composition is a refill composition for  
a trigger-type spray.

A. CLASSIFICATION OF SUBJECT MATTER  
 IPC 7 B65B9/04 B65B3/00 B65D65/46

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)  
 IPC 7 B65B B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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